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ABSTRACT

Designed to form a base for improving educational technology planning in Canada, this annotated bibliography begins with a brief discussions of trends in the use of education technology to improve and/or restructure K-12 education; indicators of a significant plan; and scanning the K-12 educational environment for strategic planning. The bibliography then presents educational technology reports, visions, and plans that were selected as representative of the wealth of useful information on how policy makers and educators are planning to shape the future of education using technology. The three sections present: (1) Educational Technology Reports, including "Trends and Issues in Educational Technology," "Transforming American Education: Reducing the Risk to the Nation," "New Tools for Teaching and Learning," "Change in Public Education," and "Technologically Enriched Schools of Tomorrow"; (2) Educational Technology Visions, including "The Future of Educational Technology," "Learning 1998: Two Futures," "Images of Potential," "Visions 2000: A Vision of Educational Technology in Alberta," and "A Third Wave Educational System"; and (3) Educational Technology Plans, including "Long Range Plan for Technology in Texas State," "Long Range Educational Technology Plan for California Schools," "Preparing Alberta Students for the Twenty-First Century," "Technology and Transformation of Schools," "Education and Technology at the Crossroads," "Systems Design of Education," "Calgary Board of Education," "Towards 2000: Shaping Our Future," "Action Plan 1990-1994: Restructuring the Education System," and "The Learning and Technology Directional Plan." (12 references) (DB)

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Hot Topic No.1

May 1991

K - Grade 12 Educational Technology Planning: The State of the Art

A Selected Bibliography

ASSOCIATION for MEDIA and TECHNOLOGY in EDUCATION in CANADA
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Organization of This Hot Topic

The opinions expressed in this Hot Topic are those of the author and not necessarily those of AMTEC. This Hot Topic has been organized into the following sections for convenience of users of this publication; an introduction describing the state of educational technology planning and a series of annotated bibliographies of educational technology reports, visions and plans.

It is hoped that this collection of information will form a base for improving educational technology planning in Canada. The annotated educational technology reports, visions and plans were selected as representative of the wealth of useful information on how policy makers and educators are planning to shape the future of education using technology. This Hot Topic is not intended to be an exhaustive bibliography, but rather representative of the literature that is available.

Questions and reactions about this Hot Topic are invited by the author. For additional information and/or to begin a dialogue, contact:

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2.3 Power On! New Tools For Teaching and Learning
(Office of Technology Assessment, Washington, D. C.: Congress of the United States, 1988)

2.4 Change in Public Education: A Technological Perspective
(Gillman, T. V., ERIC Clearinghouse on Educational Management, Eugene, Oregon, 1989)

2.5 Technologically Enriched Schools of Tomorrow
(Braun, L., The International Society for Technology in Education, Eugene, Oregon, 1990)

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3.2 Learning 1998: Two Futures
(Perelman, L. J., Chapter 2 from, "Technology and the Transformation of Schools," National School Boards Association, Alexandria, Virginia, 1987)

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1. Introduction

1.1 Trends

There is a growing interest in developing educational technology plans to improve and/or restructure education at the K - 12 level. In this regard, educational technology plans are rapidly emerging in North America at the national, state or province, school district and school levels. To some degree, this trend is due to the increased recognition of the potential of educational technology by policy makers and educators [1, 3, 5, 11, 12], but also an increased acceptance of planning as a means to shape the future of education.

These plans provide a wealth of useful information on how policy makers and educators are planning to shape the future of education using technology. For example, in 1986 the U. S. National Governors' Association report, Time For Results [10], advocated that all states, school districts and schools develop educational technology plans to achieve the potential of educational technology for making classrooms more effective and efficient. In their report, the Governors indicated that educational technology is a critical tool for education reform.

To assess the state of educational technology planning in North America at the K - 12 level, an environmental scan or search for educational technology plans was conducted. The environmental scan attempted to identify educational technology plans, both theoretical and practical, then these plans were analyzed. The environmental scan was formal and informal based on what the author was able to locate over the fall of 1990 and early 1991. Plans that were identified were analyzed with respect to five indicators judged by the author to be measures of a significant educational technology plan. These indicators were: scope of planning, type of planning, stage of educational technology evolution, time horizon, and results of planning.

Fifty-two documents were identified and these were grouped into reports, visions, and plans. The environmental scan indicated that most plans do not enter the formal literature databases and are therefore difficult to locate. About 80% of the documents identified were located using informal means. To illustrate the state of educational technology planning, twenty sample educational technology reports, visions, and plans were identified, analyzed, and described in this Hot Topic. These selected documents are representative of the materials located by the environmental scan, therefore there is a wide variation in the quality and approaches of the selected documents.

1.2 Indicators of a Significant Plan

Planning provides a process that helps give organizations a perspective on where they want to go and how they will get there. Planning usually exhibits the following five general steps: creating a base for planning and change, developing the plan, developing an implementation plan, implementing and monitoring the plan, and renewing the plan. The steps are not rigid and are not necessarily in sequence, therefore planning may vary considerably from organization to organization.

To initiate discussion about which aspects of educational technology planning would provide the best indicators for identifying a significant educational technology plan; five were proposed. These indicators are: scope of planning, type of planning, stage of educational technology evolution, time horizon, and results of planning. This proposed perspective on assessing educational technology plans is based on personal experience and reflection, buttressed occasionally by reference to the professional literature.

These indicators are inter-related, but sufficiently distinct to identify significant educational technology plans. Over the past decade these indicators have changed in emphasis. The indicators of significant plans identified and the changes in these indicators

Planning Indicators	Directions of Planning Change
scope	confined → comprehensive
type	operational → strategic
educational technology	systematic → systemic
time horizon	short range → long range

Figure 1: Directions of Change in Planning Indicators

are summarized in Figure 1.

1.2.1 Scope of Planning

The scope of a plan indicates the degree of comprehensiveness of a plan. Some plans for example only deal with one technology such as computers or distance education and are therefore confined to that area of technology. A comprehensive plan includes many technologies and/ or related educational and societal areas. Recent literature [2, 7, 9] indicates that a significant educational technology plan should include a comprehensive view of education.

1.2.2 Type of Planning

Historically, educational technology has developed through operational, rather than strategic efforts. According to McCune [7], the activity of planning and the concept of strategic planning gained momentum in the public sector in the 1980s after first becoming very popular in the business community. The operational approach is mechanistic and linear; that is, when one sees a problem, one solves it. This approach characterizes how our technological tools have been added to the education process and generally remain peripheral to teaching and learning. The more recent strategic approach is to wait until we understand the similarities and root causes of a great many related problems before developing a solution. Strategic planning is a process or series of steps that move an educational organization through [7]:

1. understanding the external forces or changes relevant to it;
2. assessing its organizational capacity;
3. developing a vision of its preferred future as well as a strategic direction to follow to achieve that vision;
4. developing goals and plans that will move it from where it is to where it wants to be;
5. implementing the plans it has developed; and
6. reviewing progress, solving problems, and reviewing plans.

A significant educational technology plan should exhibit elements of strategic planning so that planning goes beyond a mechanistic, linear process.

1.2.3 Stage of Educational Technology Evolution

Identifying changes in the way educational technology is utilized was proposed by Davies [6]. He described three levels of educational technology evolution. The past was described as the tools approach — educational technology I, where audio-visual devices are applied to the improvement of teaching. The present is described as the systematic approach — educational technology II, where methodical, rule-based linear processes are developed and applied to the facilitation of learning. Educational technology III is described as the systemic approach, where unified and dynamic wholes transform learning. Recent literature indicates [2, 4] that a significant educational technology plan should exhibit the educational technology III stage of evolution.

1.2.4 Time Horizon

Traditional planning tends to be short range, covering about one, sometimes two years. Long range plans generally exceed two years. Long range plans are usually three to five years, but some long range plans exceed a decade. It should be noted that, as the plan time horizon becomes longer, accurate predictions become more difficult. Long range planning is a significant component of planning because the future vision determines what is done in the present. A significant educational technology plan [7] should exhibit a long range perspective.

1.2.5 Results of Planning

Planning as an activity to improve education should result in success towards implementing a preferred future. Any evidence of success would separate those plans that are theoretical from those that are practical. A significant educational technology plan should describe how results will be monitored and/or reported. Ideally results would be available on the implementation of the plan.

1.3 Scanning the K - 12 Educational Environment

Environmental scanning is frequently used in the context of preparing for strategic planning [7]. For this study, environmental scanning describes the formal and informal efforts used to locate educational technology plans. Formally, the author conducted a search of the Educational Resources Information Center Clearinghouse database (ERIC), the Education Index database, the Canadian Education Index database, and the Ontario educational database (ONTERIS). Informally, personal contacts, conferences, newsletters, reports, and news clippings were scanned.

The results of the environmental scan are reported in Figure 2. Fifty-two documents were identified as either a report, vision or plan. The environmental scan indicated that most plans do not enter the formal literature databases and are therefore difficult to locate.

Type of Document	Number of Documents		
	district level	state or province level	national level
report		3	6
vision		1	7
plan	12	14	4

Figure 2: Summary of Environmental Scan.

On further analysis the environmental scan indicated that about 75% of the documents identified were from the United States and 25% from Canada and most plans were comprehensive with respect to education and/or technology. The results of the informal environmental scan identified about 80% of the documents, while the formal scan only identified 20% of the documents.

The environmental scan identified additional sources of information on technology planning. For example, the National Governors' Association, over the years 1988, 1989 and 1990 monitored the U.S. results of the educational changes advocated in the report, Time for Results [10]. A more extensive discussion of the Governor's reports is offered here because no similar monitoring of educational technology was available for Canada and the results may have relevance for educational technology planning in Canada.

With respect to educational technology planning the 1990 [4: 35] Governors' monitoring report indicated that radical changes in technology and its educational applications at all levels have occurred over the past four years and that,

> Today, almost all American schools have computers and VCRs, and students have greater access to them. More than 10,000 software products intended for educational use in schools and at home are on the market. Distance learning projects have proliferated. These developments reflect the desire of school districts, administrators, teachers, and parents to use new learning technologies.
>
> But despite the gains, technology's potential to transform and customize American classrooms remains largely unrealized. Most school districts still do not turn to technology to expand and diversify; nor has technology been integrated into the instructional practices of most classrooms. In short, little progress has been made toward the central recommendation of the task force — to use state powers to help schools reorganize, using technology and other means, so that they become more effective and efficient.

The Governor's report indicates that almost every state has an administrative office in its department of education with the responsibility for implementing state plans and programs and/or assisting local district in planning. Many states have adopted statewide educational technology plans. The report also summarizes several lessons that have been learned over the past four years. With respect to technology planning the lesson learned is that statewide policies for technology are crucial and leadership is needed to develop them. In cases in which policies have not been articulated, the planning and implementation of technology often are carried out haphazardly.

The Governor's report indicates an unfinished agenda and that significant work is needed so that technology supports the reorganization of schools. In this regard, the report states that,

> During the 1980s, many attempts have been made to launch 'schools of the future' by using new technology to drive the school vision. Educators must work instead to enable the vision of a restructured school to drive the use of technology.

A survey conducted by the U.S. Office of Technology Assessment [8: 32] in 1987 reported that: forty-one states have a technology division or staff position for educational technology, twenty-four states have a long range plan for educational technology and plans are under development in thirteen other states, forty-four states allocate funds specifically for educational technology or make other state funds available, and forty-nine states use Federal funds for technology.

With respect to educational technology planning the 1990 Governor's monitoring results [9] indicated that states are making notable progress in developing statewide telecommunication networks, administrative databases, increasing state technology funding, providing teacher training in technology, evaluating and developing software and computer curricula, developing state technology plans, and studying state technology needs and educational technology. With respect to technology planning, the report indicated that less than half of the states already have technology plans or are developing, implementing, or evaluating plans. Only five states were reported to be exploring the use of technology as a tool in school restructuring. While most school districts have formulated long-range plans for implementing technology. No similar monitoring of educational technology planning in Canada was available.

1.4 Observations and Conclusions

The author scanned formal and informal sources of educational technology planning. Many plans were identified that had some elements of the indicators elaborated earlier, but the author was not able to identify any plans that illustrated all of these indicators. In addition, an interesting and rich variety of literature was identified that did not constitute an educational technology plan, but could be a component of a more complete plan. For example, a number of educational technology visions were identified, but these would not be considered a complete plan. This Hot Topic, rather than providing an exhaustive summary of educational technology planning developments in North America, should provide an adequate overview for anyone beginning the task of educational technology

planning or comparative information for someone with an existing plan. In either case, this Hot Topic will provide an excellent starting place.

While the foregoing search and analysis was not extensive, there is evidence of a wealth of useful information on how policy makers and educators are planning to shape the future of education using technology. From the identified educational technology reports, visions, and plans the following conclusions were made:

1. The term educational technology is used in many ways with many meanings.
2. There is a wealth of recent educational technology reports, visions, and plans available to policy makers and educators.
3. A wide variety of educational technology planning approaches were identified.
4. Educational technology reports, visions, and plans are difficult to locate using formal databases. Informal methods are more successful.
5. The identified documents provide a wide range of ideas and insights about education, technology, and the future.
6. Most educational technology plans can be characterized as at an educational technology II stage of evolution.
7. There does not appear to be a educational technology monitoring effort in Canada similar to the monitoring effort by the National Governor's Association in the United States.
8. Most educational technology documents identified originated from the United States.
9. There is little evidence that educational technology plans utilize the potential of technology to transform and/or restructure education.
10. A few theoretical educational technology visions and plans were identified that can be characterized at an educational technology III level of technology evolution.

1.5 Epilogue and References

As mentioned earlier, fifty-two documents were identified and these were grouped into reports, visions, and plans. To illustrate the state of educational technology planning, nineteen sample educational technology reports, visions, and plans were identified, analyzed, and described. These descriptions make up the balance of this Hot Topic.

References for the introductory section follow:

1. Alberta Education: Visions 2000: a vision of educational technology in alberta by the year 2000. Edmonton. Alberta 1987
2. Banathy, B.: Systems design of education: a journey to create the future. Englewood Cliffs. New Jersey: Educational Technology Publications 1991
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5. Branson, R. K.: Why the schools can't improve: the upper limit hypothesis. Journal of Instructional Development, Vol. 10, No. 4. 1987
6. Davies, I.: Prologue: educational technology: archtypes, paradigms and models. In: Contributions to an educational technology (J. Harley and I. Davies, eds.). London: Butterworths 1978
7. McCune S. D.: Guide to strategic planning for educators. Alexandria. Virginia: Association for Supervision and Curriculum Development 1988
8. National Governors' Association: Results in education: 1989. Washington. D. C. 1989
9. National Governors' Association: Results in education: 1990. Washington. D. C. 1990
10. National Governors' Association: Time for results. Washington. D. C. 1986
11. Office of Technology Assessment: Linking for learning: a new course for education. Washington. D. C.: Congress of the United States 1989
12. Office of Technology Assessment: Power on! New tools for teaching and learning. Washington. D. C.: Congress of the United States 1988

2. Educational Technology Reports

The environmental scan identified nine educational technology reports. Although these reports were not educational technology plans, they contain useful components of a plan. Frequently these reports summarize recent thought, research, issues, trends and recommendations that form the basis for the development of an educational technology plan. Five sample reports were chosen to illustrate the variety and scope of the identified educational technology reports.

2.1 Trends and Issues in Educational Technology: 1988

A review of pervasive trends and issues in the field of educational technology based on a content review of professional literature. The major trends identified were:

1. Design, development, and evaluation of instructional materials and procedures is a primary concern among practitioners in the field of educational technology.

2. Professional education for teachers in the use of educational technology principles and practices is seen as a basic need for present and future professional service.

3. Distance education is becoming a significant instructional delivery system that uses technological means to reach its goals.

4. The computer is the dominant medium in the field of educational technology.

5. After computers, telecommunications and video are emerging as major media delivery systems.

6. The role of the educational technologist is unclear and varies from location to location.

7. Case studies serve as models to follow in the implementation of educational technology applications.

8. The field of educational technology is concerned about its status as a profession.

9. Educational technology principles, products, and practices are just beginning to be integrated into courses and curricula.

2.2 Transforming American Education: Reducing the Risk to the Nation

This report was developed by the National Task Force on Educational Technology for the United States Department of Education to help educational decision makers sort through the deluge of information on the usefulness of technology for learning. The Task Force members concluded that information technology represents a powerful array of tools that when creatively applied and appropriately integrated will help meet three goals: improving the quality of learning; increasing equity of opportunity, access, and quality; and ensuring greater cost effectiveness.

The report is divided into eight sections dealing with the potential of technology and recommendations to achieve that potential. The section on recommendations includes a time horizon to the year 2000. Recommendations are grouped under the following headings: planning; financing; teacher education; curriculum and instructional practice; research, evaluation, and dissemination; and demonstration schools.

Numerous recommendations are include in the report which can be characterized as at an educational technology stage II level of technology evolution.

2.3 Power On! New Tools For Teaching and Learning

Power On, is a comprehensive report that reviews recent educational technology research, practice, and thought. The report includes such topics as: the impact of technology on learning, cost effectiveness, the teacher's role, software, research and development, and the future of classroom instruction. Numerous comments are made regarding technology hardware and software including: computer assisted instruction, multimedia programs, electronic networks, word processor, convergence of information technologies, CD-ROM, hypermedia, integrated learning systems and videodiscs.

Numerous recommendations are include in the report which can be characterized as at an educational technology stage II level of technology evolution.

2.4 Change in Public Education: A Technological Perspective

From the perspective of the adoption, implementation, and integration of microcomputers into the instructional program, this report is a synthesis of recent research findings and current practice Findings are reported using the following headings: The Setting, Resources, Governance, Implementation, Process Evaluation, and Integration. One section of the report is a case study of the Sacramento City Uni-

fied School District's strategic plan. This plan includes a major emphasis on computer technology, but also includes other technologies such as: videotape, laser disk, and CD-ROM.

Numerous implications for action are included in the report which can be characterized as at an educational technology stage II level of technology evolution.

2.5 Technologically Enriched Schools of Tomorrow

Prepared by the International Society for Technology in Society, this report focuses on the role of the teacher and offers five recommendations for decision makers as they plan for the schools of the 21st century. Technology is described as a proven tool to shift the student into the knowledge worker role, fostering more interaction between students and teacher as well as among students.

The International Society for Technology in Education involved 150 leading educators at all levels of education in the preparation of this report. Major sections of the report include: evidence of the effectiveness of educational technology; school dropouts, economics, and technology; five recommendations for educational decision makers; and rationales for the set of recommendations. Among the recommendations the report calls for a student/computer ratio of no more than 5:1 by 1995. The report can be characterized as at an educational technology stage II level of technology evolution.

3. Educational Technology Visions

The environmental scan identified eight educational technology visions. Although these visions were not educational technology plans, a vision is basic to any planning. Five sample visions were chosen to illustrate the variety and scope of the identified educational technology visions.

3.1 The Future of Educational Technology

This article by Don Beckwith, summarizes the evolution of educational technology as Educational Technology I, II, and III and the difficulty the educational technology field has had in approaching the Educational III stage of evolution. Educational Technology I is the past or tools approach, Educational Technology II is the present or systematic approach, and Educational Technology III is the future or systemic approach.

He describes Educational Technology III as a powerful and worthy dream, but a dream yet to be fulfilled. In addition, pathways to the future are suggested. These pathways are;

> 1. the reaffirmation and public proclamation of the goal (the transformation of learners and the learning process) and philosophy (that all learners can be transformed to the highest levels of cognitive ability), and
>
> 2. the substitution of the traps of the systematic approach with a systemic recreation of the roles of educational technology, educational technologists, and research in educational technology.

Beckwith suggest that if we can attain the Educational Technology III stage of evolution, then;

> It could be said that if educational technology were medicine, health could be realized; if educational technology were engineering, ideal living space could be realized; if educational technology were law, peace could be realized. Educational technology as itself can realize the highest levels of cognition and affect in individuals — individuals who, in turn, will be able to create health, ideal space, and peace.

3.2 Learning 1998: Two Futures

Perelman identifies three waves of educational change or reform over the past few decades. First there was the wave concerned with access to equal educational opportunity. The second wave was concerned with raising the standards of educational achievement. Now the emerging third wave is concerned with productivity. He maintains that this third wave will lead to two possible types of educational futures by the year 1998: the business-as-usual-scenario and the transformation-of-system-scenario.

The business-as-usual-scenario visions education much as it is today, but high-tech learning systems have been directed to a privileged minority of children. In addition, because of dissatisfaction with the education system, an extensive private learning industry has grown and provided by employers. The transformation-of-system-scenario visions a new philosophy of learning and development based on mastery learning. Mastery learning is facilitated by the

extensive reliance on advanced information technology to design, manage, and deliver instruction customized to each individual learner. This transformation of education was accomplished by two central reforms: the deregulation of education and the decredentialization of education. The most impressive feature of the new education system is the great diversity of settings, methods, technologies, and styles that it includes and the wide variety of choices it offers.

Recommendation are included in this publication and it can be characterized as at an educational technology III stage of technology evolution.

3.3 Images of Potential

This report is a series of six school sketches or scenarios created by a meeting of 38 classroom teachers, hardware and software producers, corporations, school improvement and restructuring professionals, and school facilitators/designers. The scenarios depict schools at the turn of the century on a day to day basis in the future at the rural elementary school, urban/suburban elementary school, rural middle school, urban/suburban middle school, rural high school, and urban/suburban high school levels. Teacher/student interactions are described with appropriate educational technology integrated into school and community. Technology in the future is described as everywhere and available to students and teachers in the form of services, hardware and software such as: individual learning stations; small group learning spaces; large screen displays; statewide regional media centers; fiber optics; distance education; a state-wide integrated service digital network; electronic mail; a flexible computer scheduling system that manages learning experiences based on the needs of the learner; student computers at home and at school; two way interactive communications; massive electronic storage devices; laptop computers; book size computers; hologrphy; satellites; use of community, national and global learning resources; and three dimension imaging.

The scenarios are intended to stimulate teachers to employ technology as a tool in their teaching. In addition to the six scenarios, the report discusses the context, concerns, common themes and visioning strategies for incorporating technology into teaching and learning. No recommendations are included and the vision can be characterized as at an educational technology II stage of technology evolution.

3.4 Visions 2000: A Vision of Educational Technology in Alberta by the Year 2000

Arguing that technology should be incorporated into the curriculum so that students learn "about technology," "in technology," and "through technology," this report looks forward to the year 2000 and assesses ways in which technology can be applied both in the classroom and in distance education in the province of Alberta. Major sections include; The Future, A Vision of Education by the year 2000, A Vision of Technology by the Year 2000, and Educational Technology and Learning.

The vision describes a shift in the teaching-learning process of the future based on a division of labor where teachers can function in the uniquely human areas of diagnosis, prescription, motivation, and overall management of the learning process for individuals and groups of various sizes, while technology can play a greater part in exposition, simulation, and information processing and retrieval. The vision describes various forms of educational technology in use in the future, including computer-based work stations with access to local and remote databases; student access to portable computers; schools equipped with satellite receiving and transmitting equipment; widespread use of holography; student access to a variety of information sources, including primary sources; and student access at all grade levels to technological tools such as lasers, robotics, and music synthesizers.

No recommendations are included other than the plea that an educational technology action-oriented plan is urgent as a next step. The vision can be characterized as an educational technology II stage of technology evolution.

3.5 A Third Wave Educational System

Reigeluth describes a vision of a future third-wave educational system. The vision is offered as a blueprint outlining the systemic characteristics that a third-wave system might have. Designed to meet the needs of an information society; the blueprint includes a change in the teachers role to one of motivating, advising, and managing the student's learning; peer tutors; projects; and learning centers. It is proposed that a teacher would be responsible for a child for a period of three to five years, acting as a guide.

The vision includes teachers working in clusters of 4 to 10 as independent schools and students grouped by levels: Level 1 (ages 3 to 5), Level 2 (ages 6 to 9), Level 3 (ages 10 to 13), and Level 4 (ages 14 to 18).

Characteristics of the third-wave educational system include [ ]: teachers as guides; educational resources used to effect most of the learning; no traditional classes; parents are free to request moving their child if not satisfied with their child's progress; their is a financial incentive for guides to work together; and guides can send children to learning centres of various kinds to receive the best available instruction in focus areas.

No recommendations are included in this vision which can be characterized as at an educational technology stage III level of technology evolution.

4. Educational Technology Plans

The environmental scan identified thirty-five educational technology plans. Ten sample plans were chosen to illustrate the variety and scope of the identified educational technology plans.

4.1 1988 - 2000: Long Range Plan for Technology of the Texas State Board of Education

The Texas technology plan was the most comprehensive plan identified, spanning the longest period of time from 1988 to 2000. In addition, the plan is linked to the state education plan which has a mission that emphasizes quality, equity and accountability. The cumulative outcomes of the plan by the year 2000 are:

1. technology and its applications in education will be distributed equitably and sufficiently throughout Texas,
2. statewide integrated telecommunications systems will be established,
3. professional staff employed in and entering public education will be skilled in using technology for instruction and management,
4. effective integration of technology in education will continually increase,
5. applications for education of emerging technology that meet state standards will be developed and marketed at competitive prices, and
6. a Long Range Plan for Technology for the first decade of the 21st century will be prepared for implementation.

In the plan, technology is defined in terms of hardware such as: computer based systems; devices for storage and retrieval of massive amounts of information; telecommunications for audio, video and information sharing; and other electronic media devised by the year 2000 that can help meet the instructional and productivity needs of public education. Specific and extensive outcomes are elaborated in an action plan that includes three phases and five focus areas. The focus areas are: hardware, procurement, and purchase; courseware adoption and provision; training and certification; delivery systems; and research and development. Each focus area is developed over three phases: 1988-1989 through 1991-1992, 1992-1993 through 1995-1996, and 1996-1997 through 1999-2000. For example, the focus area on hardware, procurement, and purchase in phase 1996-1997 through 1999-2000 states an outcome that:

> Students will have access to workstations five hours per week, on average, in every school district. This access time yields a student : workstation ratio of 6 : 1.

Although the plan is comprehensive and strategic, the plan can be characterized as at an educational technology level II stage of technology evolution. Major strengths of the plan are the detail of the action statements, the comprehensive scope of the plan from 1988 to the year 2000, and an emphasis on results.

4.2 Long Range Educational Technology Plan for California Schools

Although the California technology plan identified is dated, it is an example of many plans identified that are at the educational technology I stage of evolution. In addition, the plan states that a technology-based program will not address the complexity of needs faced by schools. Rather the purpose of the plan is to provide a guide for others who are planning and implementing technology-infused educational programs and to promote a general consistency of use of educational technology across California.

For the most part, the plan is divided into six components: technology-infused demonstration schools, leadership, staff development, instructional materials, hardware, and facilities. Each component includes a list of objectives and strategies, but no specific time frame is included in the plan. For example, an objective in the hardware component states that:

> All schools should develop a 'foundation' program in order to acquire at least a basic quantity of hardware; such a program should permit each elementary student access to computer-based instruction at least one hour per week and secondary students two hour per week.

and an objective in the technology-infused demonstration schools component states that:

> By developing a network of technology-infused demonstration schools, the state will demonstrate the practical use of diversified technology-based resources which will support the state's overall curriculum reform effort.

This plan can be characterized as at an educational technology I stage of technology evolution. The components of a strategic plan, comprehensive scope, long range time horizon, and results emphasis are not evident.

4.3 Preparing Alberta Students for the Twenty-First Century

This comprehensive plan addresses five key areas: the environmental context, where we are, where we want to be, how we will get there, and how we will know when we get there. The plan includes all aspects of education in the province of Alberta with technology included as one of many components.

The plan is updated every year and spans a four year period. The present plan begins with 1990 and looks ahead to 1994. Major sections of the plan are devoted to the environmental context, a preferred future or vision, priority directions, and performance standards. Technology is identified as a priority direction in the plan and is described by the phrase; using technology to enhance teaching and learning. Further the plan states that;

> Technology holds much promise for better teaching and more opportunities for students to learn. Telecommunications are permitting greater access to information, the sharing of resources among schools, and the expansion of courses through distance education. Technology is also rapidly changing not only how teaching takes place but a' o what is taught in the classroom.

This plan can be characterized as at an educational technology II stage of technology evolution. The components of a strategic plan are evident except in the area of implementation. Major strengths of this plan are scope to 1994 and the emphasis on results. For example, a student outcome is stated as, "90% of Alberta students attain a high school diploma or certificate by age 19."

Arguing that technology should be incorporated into the curriculum so that students learn "about technology," "in technology," and "through technology," this report looks forward to the year 2000 and assesses ways in which technology can be applied both in the classroom and in distance education in the province of Alberta. Major sections include; The Future, A Vision of Education by the year 2000, A Vision of Technology by the Year 2000 and Educational Technology and Learning.

The vision describes a shift in the teaching-learning process of the future based on a division of labor where teachers can function in the uniquely human areas of diagnosis, prescription, motivation, and overall management of the learning process for individuals and groups of various sizes, while technology can play a greater part in exposition, simulation, and information processing and retrieval. The vision describes various forms of educational technology in use in the future, including computer-based work stations with access to local and remote databases; student access to portable computers; schools equipped with satellite receiving and transmitting equipment; widespread use of holography; student access to a variety of information sources, including primary sources; and student access at all grade levels to technological tools such as lasers, robotics, and music synthesizers.

No recommendations are included other than the plea that an educational technology action-oriented plan is urgent as a next step.

4.4 Technology and Transformation of Schools

Perelman calls for the education system to become far more productive with technology as an essential, but not independent, role. Further, he maintains that meaningful change will depend on a comprehensive sociotechnical systems design process that integrates technical systems, human resources, management and organization.

Two scenarios are described for the future of education: the 1998 business as usual scenario and the 1998 transformation-of-system scenario. The business as usual scenario results in little change to the education system, lower productivity and a large growth in employer provided education and home education. The transformation-of-system scenario employs an advanced information technology system to design, manage, and deliver instruction customized to each individual learner.

The report concludes with a policy agenda and implementation plan with a nine element strategy for a

strategy. These elements reflect what Perelman has called the sociotechnical design process. these element are: balancing planning and action, targeting functions, establishing performance and cost measures, imagineering, gap analysis, tradeoff analysis, barriers and incentives analysis, innovation budgeting and financing, and implementing.

This plan can be characterized as at an educational technology III stage of technology evolution. The plan is strategic with a comprehensive scope to the year 1998. No results emphasis is evident.

4.5 Education and Technology at the Crossroads

Hathaway has provided an extensive analysis of where education and technology is now, some alternate futures, and a description of where education and educational technology should go. He proposes the design and development of a large-scale, technologically enhanced cognitive-mapped learning system with a capacity to harness technology in a way that meets and overcomes many of the shortcomings and problems encountered by educational delivery systems of today.

The basis of Hathaway's new vision of education is a cognitive-mapped learning system that employs the resources of available technology systems (e.g. television, computers, storage media, and telecommunications), management science tools (e.g. flow-charting, network-based management systems, operations research, linear programming, queing theory, games theory, dynamic programming, and simulation), reliability and quality control (e.g. serial models and complex models), human factors analysis (e.g. physiological, social, and physical), value analysis, and planning and evaluation systems. To achieve this new learning system, a plan is presented that includes administration, developing a cognitive-mapped curriculum, evaluation, educational facilities, computer system software and a four phase implementation plan.

The plan can be characterized as at an educational technology II stage of technology evolution, but contains some elements of an educational technology III stage with respect to the cognitive-mapped learning system. The components of a strategic plan are evident. A major strength of the plan is the detail provided for the development of a cognitive-mapped learning system.

4.6 Systems Design of Education: A Journey to Create the Future

Banathy offers new ways of thinking about education and its societal function. He believes that the education system must be rebuilt by design, which is not the case now. He proposes the use of systems design to move beyond the capability of our present education system.

His book is divided into three parts: improvement or transformation, exploring alternate images, and design thinking and design practice. Banathy contends that current educational change efforts start out with an analysis of the existing system. Problems are identified and a plan is developed by which to correct the problems. Systems designers, on the other hand, start with the exploration of the overall societal context in order to formulate the purpose and the societal functions of education. They envision an ideal image of an educational system that will have the potential to attain the purpose and attend to the functions that have to be addressed in order to achieve the purpose. They design and describe the system that will have the organizational capacity and human capability to realize the image.

A vision of a future educational system is proposed, but the major strength of Banathy's book is the outline of steps to be taken to create an educational system using the systems design process. The process involves four spirals of activities that are guided by a series of questions. The first spiral involves formulating the core definitions (e.g. mission statement and statement of purposes), the second spiral involves the specifications of the new educational system (e.g. who are the clients; who should own the system; responsibilities; relationship to other levels of government; and relationship toward the community, community organizations, the private sector, volunteer agencies, and other educational agencies), the third spiral involves the design of the system functions (e.g. boundaries, building a functions model, and evaluating the model), and the fourth spiral designs the enabling systems (e.g. management systems and organization).

The plan can be characterized as at an educational technology III stage of technology evolution. The components of a strategic plan are evident, the scope is comprehensive and the time horizon is long term. The strength of the plan is in the elaboration of the steps to be used for the creation of a new educational system.

4.7 Calgary Board of Education: Strategic Plan

Strategic planning was adopted by the Calgary Board of Education in 1989 as a four step process. These steps include: first an environmental scan; second a review of current activities, identification of goals, and development of action plans; third an assignment of responsibility, set timelines, approve budget, and develop knowledge and skills; and fourth involves evaluation, monitoring, and adjustments to action plans. The summary report includes a section on strategic directions. These are:

1. Learning and Teaching;
2. Equity;
3. Leadership; and
4. Wellness.

Some references are made to technology, but without much detail. For example, the Learning and Teaching strategic direction indicates that the Board will initiate,

> Development and implementation of programs to address changes in society and the needs of the learner—examples include:
>
> - junior/senior high school transition program;
> - integration of learning and technology;
> - multicultural education;
> - environmental education; and
> - integrated curriculum."

This plan is very sketchy with respect to educational technology and is therefore difficult to assess with respect to the stage of educational technology evolution achieved. A major strength of the summary report is the extensive Strategic Scanning Report that is included as an appendix.

4.8 Towards 2000: Shaping Our Future

This plan is the County of Strathcona's strategic plan for the next five years. A summary report of the plan, released in June 1990, is divided into: an introduction, belief statements, mission statement, parameters, critical issues, and conclusions. The bulk of the summary report focuses on six critical issues and the strategies and action plans developed to respond to each issue. The eight issues identified are:

1. The need to offer programming that is responsive to changing student requirements.
2. The need to make the shift from information acquiring to an information processing orientation.
3. The need to develop a comprehensive human resources plan.
4. The need to acquire and manage resources effectively and efficiently in a time of increasing demands and diminishing resources.
5. The need to be proactive regarding natural environmental issues.
6. The need to ensure acceptance and support for the strategic directions taken by the system from all stakeholder groups, i.e. accountability, communication.

Woven into a number of these critical issues are objectives, strategies, and action plans that relate to educational technology. For example, the first critical issue states the following actions will be taken,

> By 1993, the System will identify generic instructional concepts to teach students required knowledge, skills, and attitudes in the following areas:
>
> - global awareness;
> - health;
> - technological literacy;
> - environmental literacy;
> - English language competency;
> - ethics and values; and
> - creative and critical thinking and problem solving.
>
> By 1995, the System will develop a comprehensive plan for integrating generic concepts into school programs.
>
> By 1997, the majority of teachers will be integrating these concepts into their instructional programs.

In addition, the second critical issue states objectives as follows,

> By September, 1991, all staff will be aware of the critical implications of the shift from an information giving to information processing orientation to education.
>
> By 1994, the concept of cooperative learning will be introduced in all schools.
>
> By 1996, all administrators and teachers will reflect an information processing orientation and use information processing technologies in the delivery of curriculum to their students.
>
> By 1992, 95% of appropriate staff will be using computer technology in the workplace.
>
> By 1994, 50% of our teachers will be accessing internal computerized data bases.
>
> By 1996, 50% of our teachers will be accessing external computerized data bases.

This is an impressive plan because of the integrated and wholistic approach used. From an educational technology point of view, the plan can be characterized as at an educational technology II stage of evolution.

4.9 Action Plan 1990-1994: Restructuring the Education System

The Ontario Ministry of Education has developed an action plan that is a "framework for consultation" to bring about improvements in elementary and secondary education in Ontario. The action plan is organized into six areas representing broad strategies for change. These are;

- the Early Years (Junior and Senior Kindergarten)
- the Formative Years (Grades 1 to 6)
- the Transition Years (Grades 7 to 9)
- the Specialization Years (Grade 10 to Ontario Academic Courses)
- Technological Education
- Teacher Education

The plan lacks detail in some repects (e.g. results indicators and/or criteria), but is exellent with respect to providing a comprehensive overview. the bulk of the plan focuses on the six strategies for change and timelines for each action. For example, the technological education strategy includes thirty-eight components grouped into nine areas. The component areas are;

- Policy
- Data Research
- Legislation
- Funding
- Consultation
- Communications
- Marketing
- Teacher-Preservice / In-Service
- Impact Analysis of Policy

This is an impressive plan because of the integrated and wholistic approach used. The technological strategy is very comprehensive (e.g. the policy area includes the development of policy statements on: cooperative education, curriculum, career education, post secondary linkages, teacher qualifications, and competency-based student evaluation). From an educational technology point of view, the plan is difficult to classify because of lack of detail. The plan is estimated at an educational technology II / III stage of evolution.

4.10 The Learning and Technology Directional Plan: 1989 -1990

This Plan is really a plan for a plan. The document lays the ground work for a plan that will span 1991 to 1995. First, key planning influences are identified. For example, the Ministry of Education provincial educational directions that are elaborated in the report Year 2000: A Framework for Learning and the development of a five year Greater Victoria District plan.

One section elaborates these planning influences. For example, an interesting planning influence from the report Year 2000: A Framework for Learning is summarized as follows,

> ...we must create learning environments in which the student is empowered to take charge of his or her own learning at all three program levels — Primary, Intermediate, and Graduation. This suggests a greater sense of self-direction on the part of the individual learner and a changing relationship between the teacher and the learner as the teacher facilitates and guides the learner on the journey to understanding. It also suggests the need for flexible and adaptable resources and tools that support such a model.

Another section elaborates specific areas of focus. This section is called "Charting Our Course" and focuses on; a focus on tools for conceptualization, a learning resources focus, a focus on tools for teachers, and a focus on information and communication.

As a plan for a plan, a number of strategies are identified to achieve a multi-year plan from 1991 to 1995. These strategies are:

1. The implementation of technology within learning environments will be in the context of the school's plans to achieve the goals of student learning.

2. As a District, we shall follow an innovation management cycle which includes: identifying needs, innovating solutions, integrating successful approaches, and implementing agreed strategies.

3. Schools will work towards all staff having familiarity and facility with the use of technology currently in the school.

4. The District will coordinate the revisioning of the library as a potential centre for information and communication within the school environment.

5. The District will review the development of student information and administration systems in light of the increased emphasis on accountability and the focus on assessment within the Year 2000: AFramework for Learning.

6. The District will provide coordination of the development of multi-media learning resources that support the new curriculum and assessment framework.

7. The District will work to provide an integrated approach to funding for technological learning resources and their on-going costs that is based on providing flexible access to students.

8. The District will develop an equipment budget that reflects the current level of capital investment.

9. The District will review its current and future needs to provide maintenance, wiring, and other support services required to fully utilize the investment in technology.

10. The District will review its directional strategy on an annual basis to ensure that our actions are coordinated with the curriculum and assessment framework implementation.

This is potentially an impressive plan because of the integrated and wholistic approach used, particularly with respect to teaching and learning in the future. It is difficulty to characterize the plan because it is in the process of being built. The plan is estimated at an educational technology II /III stage of evolution.